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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/583,121	03/19/2007	Igor Lvovich Skryabin	GRIHAC P48AUS	3214

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EXAMINER	
RIPA, BRYAN D	

ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/583,121	SKRYABIN ET AL.	
	Examiner	Art Unit	
	BRYAN D. RIPA	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 April 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-26* is/are pending in the application.

4a) Of the above claim(s) *18 and 19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-17 and 20-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 June 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/16/06; 10/29/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of claims 15-17 and 23-26 in the reply filed on April 9, 2010 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 18 and 19 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on April 9, 2010.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

3. The drawings are objected to because figure 1 fails to adequately label the elements as described by the specification (see generally figure 1 and ¶27). More specifically, as described by the specification, 1 is supposed to denote the substrate but

instead appears to be denoting the electrolytic tank (see figure 1 and ¶27). Also, 3 is suppose to be denoting the reference electrode but instead in the figure is denoting the electrolyte. Furthermore, electrolyte 6 is not depicted at all despite being referred to in the specification (see ¶27).

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 22 and 24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 22, claim 22 recites the limitation "the nano-particulate layer" in the fourth and fifth lines of the claim. However, there is insufficient antecedent basis for this limitation in the claim.

Regarding claim 24, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Please note, for examination purposes the "such as" clause is being treated as being one example of a suitable process and not as required by the previous claim limitation requiring the transferring of the plating charge to occur under constant current conditions.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 14-16, 20, 21 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al., "Modification of Electrodes in Nanocrystalline Dye-Sensitized TiO_2 Solar Cells" *Solar Energy Materials & Solar Cells* 65, pages 193-200 (2001) (hereinafter referred to as "LEE") .

Regarding claim 14, LEE teaches a method for manufacturing a nano-particulate electrode for Dye Solar Cells (see generally pages 193-194) including the steps of:

- providing an electrically conductive substrate (see page 194 under the "Experimental Procedure" section, subsection 2.1 teaching the formation of TiO_2 electrode on a conductive FTO glass, i.e. SnO_2:F);
- forming a nano-particulate layer on the substrate (see page 194 under the "Experimental Procedure" section, subsection 2.1 teaching the formation of a nano-particulate layer, i.e. TiO_2, to form an electrode);
- applying a dye to the nano-particulate layer (see pages 194 and 195 under the "Experimental Procedure" section, subsection 2.2 teaching the application of a ruthenium complex dye to sensitize the TiO_2 electrode); and

- an additional step of electrolytically treating the nano-particulate layer in an electrolyte (see page 195 under the "Experimental Procedure" section, subsection 2.3 teaching the further modification of the TiO_2 electrode by electrodepositing a TiO_2 layer over the previously applied TiO_2 layer; see also page 196).

Regarding claim 15, LEE teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of the electrolyte containing ions chemically different to the nano-particulate layer (see page 195 under the "Experimental Procedure" section, subsection 2.3 teaching the electrolyte containing Na^+, Cl^-, and HCO_3^-) and the electrolytic treatment step comprises transferring material from the electrolyte in the form of ions into the surface of the nano-particulate layer resulting in formation of a barrier-layer having electronic properties that differ from that of the original nano-particulate layer (see page 196 subsection 3.2 teaching the electrodeposited electrode having an altered short-circuit current density and open-circuit voltage thus implicitly teaching the electrodeposited layer having electronic properties that differ from the original nano-particulate layer as claimed).

Regarding claim 16, LEE teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of heating to ensure stable bonding of the barrier layer to the nano-particulate layer following the electrolytic

treatment step (see page 195 under the "Experimental Procedure" section, subsection 2.3 teaching the annealing of the electrodeposited modified electrode at 450°C).

Regarding claim 20, LEE teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of using a metal or a mixed metal oxide as the nano-particulate layer (see page 194 under the "Experimental Procedure" section, subsection 2.1 teaching the formation of a nano-particulate layer, i.e. TiO_2, to form an electrode).

Regarding claim 21, LEE teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of using titanium dioxide as the metal oxide (see page 194 under the "Experimental Procedure" section, subsection 2.1 teaching the formation of a nano-particulate layer, i.e. TiO_2, to form an electrode).

Regarding claim 23, LEE teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of transfer of a predetermined amount of electrical charge between the electrolyte and the nano-particulate layer (see page 195 under the "Experimental Procedure" section, subsection 2.3 teaching the transfer of charge until a constant charge transfer is reached, which is a predetermined amount that could be said to be a measure of the amount of electrical charge as claimed).

6. Claim 22 is rejected under 35 U.S.C. 102(b) as being anticipated by Karuppuchamy et al., "Cathodic Electrodeposition of Oxide Semiconductor Thin Films and Their Application to Dye-Sensitized Solar Cells" *Solid State Ionics* 151, pages 19-27 (2002) (hereinafter referred to as "KARUPPUCHAMY").

Regarding claim 22, KARUPPUCHAMY teaches a method for manufacturing a nano-particulate electrode for Dye Solar Cells (see generally pages 19-20) including the steps of:

- providing a substrate (see page 20 under the "Experimental" section, subsection 2.1 teaching the use of ITO coated glass plates as the conductive substrate); and
- electrolytically depositing the nano-particulate layer from an electrolyte and application of dye to the nano-particulate layer (see both the TiO_2 thin film sample and the ZnO/N3 hybrid thin film samples discussed on pages 20 and 21 under the "Experimental" section, subsections 2.1.1 and 2.1.2 each teaching the electrolytic deposition of a nano-particulate layer with the application of a dye).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 17, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over LEE as applied to claim 14 and further in view of Zangari et al., (U.S. Pub. No. 2002/0145826) (hereinafter referred to as "ZANGARI") with evidence from Sager et al., (U.S. Pat. No. 6,852,920) (hereinafter referred to as "SAGER") and Lopatin et al., (U.S. Pat. No. 6,340,633) (hereinafter referred to as "LOPATIN").

Regarding claims 17, 25 and 26, LEE does not teach the partial removal of material from the nano-particulate layer to the electrolyte during the electrolytic treatment, the electrolytic treatment including first and second half-cycles wherein the first half-cycle is a deposition step and the second half-cycle is a removal step, and the electrolytic treatment including first and second cycles where the second cycle is larger than the first.

It is noted that the above noted limitations all appear to relate to the use of a pulse-reverse electrodeposition or periodic reverse electrodeposition method. However, ZANGARI teaches the use of various plating waveforms such as a pulse-reverse electrodeposition method for depositing metal oxides that includes alternating periods of deposition and removal of ions from the substrate (see ¶36). Additionally, ZANGARI teaches that it is known to alter the timing of the waveform pulses (see ¶33). Moreover, as evidenced by SAGER, it is known in the art that one of the benefits of using an electrodeposition method is the ability to alter the properties of the deposited layer by varying the waveform properties (see col. 10 lines 32-64 teaching the benefits of using a pulsed plating electrodeposition technique including control over the crystal sizes, crystallinity and adhesion of the formed nanostructure layers).

Additionally, as evidenced by LOPATIN, the use of an increasing pulse reverse current waveform is also known (see figure 4a).

Consequently, it would have been obvious to one of ordinary skill in the art to alter the times of the deposition and removal steps so as to enable the formation of a layer having the desired properties.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use various waveforms including a reverse pulse waveform having the characteristics as claimed for forming the layer having the desired properties.

8. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over LEE as applied to claims 14 and 23, and further in view of Cohen, (U.S. Pat. No. 4,142,947) (hereinafter referred to as "COHEN") with evidence from SAGER.

Regarding claim 24, LEE does not teach the deposition waveform being a constant current waveform.

However, COHEN teaches the use of a constant current waveform for the deposition of a nonmetal coating (see col. 4 lines 49-52).

Furthermore, as evidenced by SAGER, it is known in the art that one of the benefits of using an electrodeposition method is the ability to alter the properties of the deposited layer by varying the waveform properties (see col. 10 lines 32-64 teaching the benefits of using an electrodeposition technique including control over various properties of the deposited layer as well as control over the deposition rate).

The simple substitution of one known element for another is likely to be obvious when predictable results are achieved. See *KSR Int'l Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1395–97 (2007) (see MPEP § 2143, B.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use a constant current waveform for forming the layer.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

1) U.S. Pub. No. 2003/0013008 to Ono, which teaches the formation of a TiO_2 particle layer by a subsequent electrolytic treatment step in a formation method for manufacturing dye sensitized solar cells (see ¶76).

2) U.S. Pat. No. 6,245,988 to Gratzel, which teaches the formation of a TiO_2 particle layer by a subsequent electrolytic treatment step in a formation method for manufacturing dye sensitized solar cells (see col. 13 line 10-col. 14 line 30).

3) "Electrodeposited Nanocomposite n-p Heterojunctions for Solid-State Dye-Sensitized Photovoltaics" by Regan et al., *Adv. Mat.* 12 (17), pages 1263-1267 (2000), which teaches the formation of a ZnO and CuSCN layer by a subsequent electrolytic treatment step in a formation method for manufacturing dye sensitized solar cells (see pages 1266 and 1267).

4) "Improved Performance of a Dye-Sensitized Solar Cell using a TiO_2/ZnOEosin Y Electrode" by Kim et al., Solar Energy Materials & Solar Cells 79, pages 495-505 (2003) which teaches the formation of a ZnO layer by a subsequent electrolytic treatment step in a formation method for manufacturing dye sensitized solar cells (see pages 496 and 497).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRYAN D. RIPA whose telephone number is 571-270-

7875. The examiner can normally be reached on Monday to Friday, 9:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. D. R./
Examiner, Art Unit 1795

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1795